



The " District Heating Wall" : A Synergistic Approach to Achieve Affordable Carbon Emission Reductions in Old Terraced Houses

PDF (Size: 771KB) PP. 115-129 DOI : 10.4236/lce.2012.323016

Author(s)

Claire Frost, Fan Wang, Paul Woods, Robert MacGregor

ABSTRACT

One effective method to help the UK achieve GHG emission reduction targets is to reduce and decarbonise the heat demand of solid-walled terraced houses, as there are over 2.5 million such buildings making up a significant proportion of the whole building stock. Currently measures are achieved separately: the heat demand could be reduced by application of External Wall Insulation (EWI) or decarbonised through low carbon heat supplied by District Heating Networks (DHN). However, when installed individually, both these technologies face economic cost barriers. This study presents a novel solution that combines district heating pipes into external wall insulation—the District Heating Wall (DHWall)—and provides a systematic and quantitative assessment on its effects on the heating loads and its associated carbon emissions and capital costs. First a dynamic thermal model was developed to predict the heat demand of a case study terraced house with and without EWI. Two district heating networks were then sized to transport the required heat to the house—conventional and DHWall. The DHWall was compared to existing options and initial design parameters calculated. The study found application of EWI reduced space heating demand by 14%. The DHWall could reduce mains pipe inside diameter by 47% and reduce network pipe lengths by 20% and require no civils cost. Together these factors reduced DH capital costs by 76%. For one terraced house, the DHWall saved 34 tonnes of carbon over a 20year period compared to 8tonnes saved by EWI alone. Such savings were achieved at 39% of the cost/tonne. The mains pipe of the DHWall was calculated to have an inside diameter of 32.6 mm. The minimum insulation thickness required for solid walls to reach U-values of 0.3 W/m²K was calculated to be 120 mm of mineral wool or 65 mm of phenolic foam. The study concludes the DHWall has potential to contribute to GHG emission reductions by increasing market penetration of DH and EWI and should be investigated further.

KEYWORDS

CO₂ Emissions; Energy Efficiency; District Heating; External Wall Insulation; DHWall; Dynamic Thermal Modelling; Pipe Sizing

Cite this paper

C. Frost, F. Wang, P. Woods and R. MacGregor, "The " District Heating Wall" : A Synergistic Approach to Achieve Affordable Carbon Emission Reductions in Old Terraced Houses," *Low Carbon Economy*, Vol. 3 No. 3A, 2012, pp. 115-129. doi: 10.4236/lce.2012.323016.

References

- [1] Poyry Energy Consulting, and Faber Maunsell AECOM, " The Potential and Costs of District Heating Networks," Department of Energy and Climate Change, London, 2009.
- [2] J. I. Utley and D. T. Shollock, " Domestic Energy Fact File 2008," Department of Energy and Climate Change, BRE, Watford, 2008.
- [3] Communities and Local Government (CLG), " English House Condition Survey (EHCS) 2007," Committee on Climate Change, 2007.
- [4] Committee on Climate Change (CCC), " The Fourth Carbon Budget," 2010. www.theccc.org.uk/carbon-budgets/4th-carbon-budget-path-to-2030
- [5] Energy Saving Trust (EST), " UK Domestic Solid Wall Insulation: Sector Profile," 2008.

- [Open Special Issues](#)
- [Published Special Issues](#)
- [Special Issues Guideline](#)

[LCE Subscription](#)
[Most popular papers in LCE](#)
[About LCE News](#)
[Frequently Asked Questions](#)
[Recommend to Peers](#)
[Recommend to Library](#)
[Contact Us](#)

Downloads:	49,896
------------	--------

Visits:	141,960
---------	---------

Sponsors, Associates, and
 Links >>

- [6] Changeworks, " Solid Wall Insulation in Scotland: Exploring Barriers, Solutions and New Approaches," 2012. <http://www.changeworks.org.uk/>
- [7] Rockwool, " Rockwool RockShield Data Sheet," 2011. guide.rockwool.ie/products/building-insulation/rockshield.aspx
- [8] Wetherby " External Wall Insulation—Refurbishment/System Components/Insulants," 2012. www.wbs-ltd.co.uk/refurb_components_insulants.htm
- [9] DECC, " Green Deal Consultation," 2011. www.decc.gov.uk/en/content/cms/consultations/green_deal
- [10] P. S. Woods, " Proposal Submitted for Implementing Agreement on District Heating and Cooling including CHP Call for Proposals for Annex X," International Energy Agency, 2010.
- [11] CIBSE, " CIBSE Guide A: Environmental Design," The Chartered Institution of Building Services Engineers," CIBSE, Norwich, 2006.
- [12] IES, 2012. www.iesve.com/software/ve-pro
- [13] A. H. Abdullah and F. Wang, " Design and Low Energy Ventilation Solutions for Atria in the Tropics," Sustainable Cities and Society, Vol. 2, No. 1, 2012, pp. 8-28. doi:10.1016/j.scs.2011.09.002
- [14] S. Muthesius, " The English Terraced House," Yale University Press, New Haven, 1982.
- [15] D. C. Rye, " The SPAB Research Report 1: U-Value Report," 2011.
- [16] H. M. Government " The Building Regulations 2000, Conservation of Fuel and Power, L1B: Conservation of Fuel and Power in Existing Dwellings," 2010.
- [17] Rockwool, " An Introduction to Part L-U-Values," 2010.
- [18] Energy Saving Trust, (EST), " Final Report: In-situ Monitoring of Efficiencies of Condensing Boilers and Use of Secondary Heating," 2009. www.decc.org.uk
- [19] DECC " About the National Heat Map," 2012. ceo.decc.gov.uk/en/ceol/cms/heatmap/about_map/about_map.aspx
- [20] Arup, " Decentralised Energy Masterplanning, A manual for Local Authorities. Report for Dept of Energy and Climate Change," 2011. www.chpa.co.uk/medialibrary/2012/01/05/46ccc22e/DENet_manual_lo_v1%200.pdf
- [21] International District Heating Association (IDHA), " District Heating Handbook: A Design Guide," International District Heating Association, Washington, 1983.
- [22] DECC, " Lower Layer Super Output Area (LLSOA) Domestic Gas Estimates 2010: Look-up Spreadsheets," 2012. www.decc.gov.uk
- [23] DECC, " Sub-National Energy Consumption Statistics," 2012. http://www.decc.gov.uk/en/content/cms/statistics/energy_stats/regional/regional.aspx
- [24] Rehau, " District Heating and Heat Networks: CPD Presentation," 2012. www.rehau.co.uk.
- [25] " DS 439:2009, Norm for Vandinstallationer, Code of Practice for Domestic Water Supply Installations," 2009.
- [26] Rehau RAUTHERMEX: Technical and installation manual 817600 EN, 2011.
- [27] CIBSE, " CIBSE Guide C: Reference Data," Chartered Institution of Building Services Engineers, London, 2007.